Center for Independent Experts (CIE) Review of

Evaluation of Fishing Activities That May Adversely Affect Essential Fish Habitat

Appendix B of Draft Environmental Impact Statement

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14 June 2004

Executive summary

The model estimates the long term effects on five defined habitat features (infauna, epifauna, living structure, non-living structure and hard coral) resulting from fishing at the current fishing intensity. This provides a reasonable approach for understanding the main direct effects caused by fishing gears on those habitat features. A more detailed understanding requires more data, and not necessarily a better model. The model seems well designed for the data available.

It is not totally clear whether the best available information is used. Some alternative analysis with additional data (such as observer data on by-catches of corals) could have been completed. Historic time series of fishing effort should have been documented as a background for evaluating whether equilibrium between gear impact and habitat recovery has been reached.

The knowledge is nearly absent on the quantitative linkage between the quantified effects on the above mentioned habitat features and the features that are essential for each specific fish stock. Even the qualitative linkage is, in many cases, poor. Therefore, the approach for identifying whether fishing activities adversely affect EFH in a manner that is more than minimal and not temporary had to include criteria other than the direct effect on the habitat itself. A spawning stock above the minimum stock size threshold (MSST) was used, as an indication that its essential habitat was not adversely affected by fishing. I consider this as a relevant criterion, but it is not a powerful test to prove or disprove that current fishing affects EFH in a way that is more than minimal and not temporary. Recruitment trends and signs of shrinking stock distribution could have been used as additional criteria for detecting the stocks' response to possible adverse effect of fishing on habitat. The weakness of measuring the effects at the stock level is that, due to large annual variability, only quite strong effects are likely to be detected.

In my view, the MSST considerations have been given too much weight in the stock by stock evaluations and have been interpreted in the direction of no evidence of adverse effects of fishing on EFH. In cases when stocks are above MSST (or rather B_{MSY}), I would conclude that the stock assessments give no evidence for reduced production. This does not exclude that possible effects may exist and might reduce stocks and fisheries in the future. For stocks observed to be associated with slowly recovering living structure I would add a warning that these species might be dependent on vulnerable habitats, and further protection of those habitats would be a precautionary step to reduce the risk of future losses to the stock, fishery and ecosystem.

Background

The Magnuson-Stevens Fishery Conservation and Management Act requires that every fishery management plan describe and identify Essential Fish Habitat (EFH) for the fishery, minimize to the extent practicable the adverse effects of fishing on EFH, and identify other measures to promote the conservation and enhancement of EFH. The National Marine Fisheries Service (NMFS) and the North Pacific Fishery Management Council recently developed a draft environmental impact statement (DEIS) to consider the impacts of incorporating new EFH provisions into the Council's fishery management plans. The DEIS evaluates three actions: (1) describing and identifying EFH for fisheries managed by the Council; (2) adopting an approach for the Council to identify Habitat Areas of Particular Concern within EFH; and (3) minimizing to the extent practicable the adverse effects of Council-managed fishing on EFH. Most of the controversy surrounding the level of protection needed for EFH concerns the effects of fishing on sea floor habitats. Substantial differences of opinion exist as to the extent and significance of habitat alteration caused by bottom trawling and other fishing activities. Although an increasing body of scientific literature discusses the effects of fishing on habitat, there is no consensus within the scientific community on an appropriate methodology for analyzing potential adverse effects.

The national EFH regulations (50 CFR 600.815(a)(2)) require an evaluation of the effects of fishing on EFH, and this evaluation appears in Appendix B to the DEIS. The evaluation has two components: a quantitative mathematical model to show the expected long term effects of fishing on habitat; and a qualitative assessment of how those changes affect fish stocks. The model estimates the proportional reductions in habitat features relative to an unfished state, assuming that fishing will continue at the current intensity and distribution until the alterations to habitat and the recovery of disturbed habitat reach equilibrium. The model provides a tool for bringing together all available information on the effects of fishing on habitat, such as fishing gear types and sizes used in Alaska fisheries, fishing intensity information from observer data, and gear impacts and recovery rates for different habitat types. Due to the uncertainty regarding some input parameters (e.g., recovery rates of different habitat types), the results of the model are displayed as point estimates as well as a range of potential effects.

After considering the available tools and methodologies for assessing effects of fishing on habitat, the Council and its Scientific and Statistical Committee concluded that the model incorporates the best available scientific information and provides a good approach to understanding the impacts of fishing activities on habitat. Nevertheless, the model and its application have many limitations. Both the developing state of this new model and the limited quality of available data to estimate input parameters prevent drawing a complete picture of the effects of fishing on EFH. The model incorporates a number of assumptions about habitat effect rates, habitat recovery rates, habitat distribution, and habitat use by managed species. The quantitative outputs of the analysis may convey an impression of rigor and precision, but the results actually are subject to considerable uncertainty.

One major limitation of the model is that it does not consider the habitat requirements of managed species or the distribution of their use of habitat features. Therefore, DEIS analysts were asked to use the model output to address whether continued fishing at the current rate and intensity is likely to alter the ability of a managed species to sustain itself over the long term. In other words, are the fisheries, as they are currently conducted, affecting habitat that is essential to the welfare of each managed species? To help answer that question, the analysts considered available information about the habitats used by managed species. The analysts also considered the ability of each stock to stay above its minimum stock size threshold (MSST), after at least thirty years of fishing at equal or higher intensities. MSST is the level below which a stock is in jeopardy of not being able to produce its maximum sustainable yield on a continuing basis.

The DEIS analysis concludes that despite persistent disturbance to certain habitats, the effects on EFH are minimal because there is no indication that continued fishing activities at the current rate and intensity would alter the capacity of EFH to support healthy populations of managed species over the long term. The DEIS finds that no Council-managed fishing activities have more than minimal and temporary adverse effects on EFH, which is the regulatory standard requiring action to minimize adverse effects under the Magnuson-Stevens Act. Additionally, the analysis concludes that all fishing activities combined have minimal, but not necessarily temporary, effects on EFH. These findings suggest that no additional management actions are required pursuant to the EFH regulations.

Description of review activities

The bibliography list (Appendix I) and the Statement of Work (Appendix II) describe the documents reviewed and review activities, respectively, as part of a independent peer review completed for the Center for Independent Experts (CIE). Background materials were made available on the web nearly four weeks before the June 2004 review meeting. I perused this material before the meeting, including a more detailed study of the EFH DEIS Appendix B. Some additional material was made available one week before the meeting. The panellists were encouraged to send relevant questions before the meeting.

The review meeting was held for a full day at the Alaska Fisheries Science Centre in Seattle on June 29, 2004. Jon Kurland, of the Centre, presented some background for the work on the Essential Fish Habitat Environmental Impact Statement. Some additional documents were handed out (documents 8-12 in the bibliography list, in Appendix I). Dr. Jeffrey Fujioka and Dr. Craig Rose described the development of the model and presented the application of the model. Dr. Craig Rose and Dr. Anne Hollowed described the analytical approach for assessing effects of fishing on EFH and managed species. Here, much more detail on stock assessments and surveys were presented than what is included in the EFH DEIS Appendix B. The review panel submitted its comments and raised questions that were answered by the presenters.

The panel met in executive session at the Alaska Fisheries Science Centre on June 30, 2004 to discuss the information presented and to identify any unanswered questions.

After the meeting, I solicited a document (document 13) from Jon Kurland. Additional sections of the Draft Environmental Impact Statement were located on the web.

<u>My approach to the review</u>

I consider that the main task for the review panel is to evaluate the work and conclusions presented in the EFH DEIS Appendix B, and that the main purpose of the additional documents for review is to inform about the context of the work and the various public opinions about some of the key topics treated. In particular, there are different opinions about the terms of reference for the work. These relate to the interpretation of the Magnusson Stevens Act, various council resolutions from the NPFMC and to various documents within the EFH DEIS. As an outsider, not knowing the real “authority ranking” of these various documents, I find it difficult to comment on this aspect of the review. I have rather based my evaluations on the following considerations: I regard Appendix B as a scientific document that provides advice and scientific background on fisheries management. The responsibility of the science is then to, using the best scientific information, to reach conclusions and provide advice by also considering the risks involved in the lack of precise knowledge, which involves both the risk for not taking management actions when there is a real need versus the risk of taking costly actions for false reasons.

Summary of findings

The numbers specified in the list of bibliography are used as reference to the various documents.

Based on my study of Appendix B and the presentations at the Seattle meeting, my brief summary of Appendix B is as follows.

The biological knowledge is too scarce both for describing the “real” EFH on a stock by stock basis and for describing bottom habitats in general, based on sediment types and their associated fauna. A full description and quantification of all processes linking the fish to its environment is not achievable. The approach followed was to define a few physical bottom habitats (5 in Bering Sea, 2 in Aleutians, 3 in Gulf of Alaska) based on some available information on sediment types/topography. Within these physical habitats the following habitat features were considered: infauna, epifauna, living shelter, non-living shelter, and hard coral. The long term effects of continued fishing at current fishing intensity (and current distribution of fishing intensity) were estimated as the percentage reduction of habitat at equilibrium (balance between gear impact and recovery capability) relative to the pristine condition. This is referred to as the long term effect index (LEI). With all its weaknesses, this is a very valuable achievement.

Stock specialists were then asked to assess whether the fisheries, as they are currently conducted off Alaska, are affecting habitat that is essential to the welfare of the species in a way that is more than minimal and which is not temporary.

The current stock situation relative to its minimum threshold (MSST) was used as an overall test to determine whether stocks at present support a sustainable fishery and contribute to a healthy ecosystem. MSST is an existing, well-accepted benchmark, and it was considered to be consistent between stocks.

My main conclusion is that the general approach and modelling is good, while the stock by stock evaluations are too dependent on the MSST consideration. In several cases some warnings should be spelled out more clearly, pointing to likely linkage between stocks and estimated LEI values (also locally), even if there is yet no evidence for reduced stock productivity.

Question 1: Does the model incorporate the best available scientific information and provide a reasonable approach to understanding the effects of fishing on habitat in Alaska?

Here I have assumed that the term **model** covers the calculation procedure leading to estimates of Long Term Effect Index (LEI).

a. Does the model provide a reasonable approach?

Given that a complete habitat description and a full quantitative linkage to what is essential for the various fish stocks is far from achievable with current knowledge, the chosen model approach is quite reasonable. It focuses on areas where some data exists: fishing effort by gear type, gear effects on seafloor, and recovery rates for seafloor related species. The model is designed to estimate long term effects at fixed fishing intensity and allows both for estimating local effects and fleet effects, and for integrating effects over the fleets and areas relevant to each stock (or management area). It has few parameters and is therefore rather transparent and allows for simple sensitivity analysis.

Since the model is simple, it involves simplifications of a number of complicated processes. In my view the most important simplifications relating to the use of available data are:

1. Fishing intensity is assumed to be random relative to habitats (within 5x5 km squares). This underestimates effects on the habitats that fishermen tend to prefer, and overestimates the effects on habitats they tend to avoid.
2. Habitat recovery is assumed to be a continuous process. This could be true if the main recovery mechanism is migration or dispersion of animals from neighbouring areas. If recovery involves recruitment, it might rather be a once a year event.
3. Habitat reduction (due to fishing activities) is assumed to be a continuous process. This will not be true in case of seasonal fisheries or fisheries following a migrating fish concentration.

Better information on fishermen’s behaviour (through interviews, perhaps) could be handled by the present model formulation and would improve the analysis. By considering an equilibrium condition, the temporal aspect is removed in calculating LEI, and a modified model would be required to handle seasonal effects. Without detailed knowledge on the various recovery mechanisms, the gains of using a seasonal model would probably be small.

Tagart (document 7b) has shown how the basic equations can be used for estimating the time to reach equilibrium when starting from a pristine condition with current fishing intensity. Similar calculations might be done for estimating the time needed for reaching a new equilibrium when a change in fishing intensity is introduced. Such calculations based on available history of fishing intensity in these areas would have been a very useful background for evaluating whether we currently are close to or far from equilibrium for the various habitat features. At least a time series of total fishing effort should have been included in the document to indicate the typical variation in effort over the years.

The sensitivity of the model is not extensively explored in Appendix B, but some analyses give indication of the sensitivity. LEI values for a range of combinations of the I and ρ parameters are shown, and full analysis are made with high, low and median parameter values. All calculations are based on a recent 5-year average fishing effort, both with respect to geographical distribution and total values. This strictly means that in future the conclusions based on these LEI values will only be valid if fishing effort does not increase in any of the defined 5x5 km squares. This also implies that the conclusions may not be valid if some future effort is allowed in squares that were unfished during the 5-year period. It might be difficult to ensure that effort will not increase in future (due to technological changes or changes in stock size relative to quotas). The sensitivity to changes in effort is therefore a highly relevant topic. Since $I=f*q$, this can be simply judged from the sensitivity of I or q (tables B.2-1 and B.2-5 as well as document 7b). Therefore, the effect of a 50% increase in effort would be the same as the effect of a 50% increase in q.

The main conclusion is that the highest LAI values are found for those habitat features with low recovery rates, even if fishing intensity is moderate. This is true in the case of assuming high, medium or low effect-combinations of both ρ and I values. Thus, the main conclusions are robust within a large range (i.e. a factor of 2) for the parameter values, and therefore also rather robust for variation in total fishing effort. Realizing that gear impacts are most serious for features with low recovery rates means that valuable information is obtained by just looking at the geographical overlap between fishing effort and the distribution of slowly recovering habitat features (ex. sponges and corals).

My conclusion is that the model presents a reasonable approach for understanding the most obvious direct effects on the habitat features concerned. Further understanding requires further data, not necessarily a better model.

b. Does the model incorporate the best scientific information?

This topic is always a matter of judgement, based on relevance, precision and consistency among data sources. Such judgements are also related to the purpose of the study. My impression from our review meeting is that, in this study, consistency has been an important criterion for selecting data for quantitative use. There is a balance between using large amounts of partly inconsistent information (with unknown effects for the final consistency between areas and stocks and fishing fleets) and less but more consistent information. Some alternative analysis including more data might have revealed how sensitive the conclusions are to the selection of data.

Bottom substrates

For classifying bottom substrates, there seems to be more information available than what is directly used. Some details were available for only lesser parts of the area, and some sources categorised sediment types differently. In addition, some of the available information was quite old, which has since been proven to be incorrect for some locations. Several of the written comments available for our review (documents 7a, c, and d) commented that observer data on by-catches of corals and sponges had not been fully utilised. At the review meeting, it was commented that some of this information could be misleading. Fragments of corals could be tangled in the forepart of the trawl and not recorded in the real catch position; instead, the position could be recorded incorrectly when these fragments during a later tow was washed into the codend. In my opinion, it would be useful to show the effect of including these data, especially since coral is highly vulnerably to gear impacts.

Gear impact and recovery rates

For quantifying gear impact and recovery rates, only results that allowed for estimating the defined parameters (q and ρ) were used, while other observations (those that could not be translated to q or ρ) were qualitatively examined for consistency with the results of the studies used. Several ρ values are obtained from the literature where the duration from time of impact to time of recovery is reported. In cases when recovery tends to be an asymptotic process with respect to time, the time of full recovery might be measured with high uncertainty. Assuming an asymptotic (or sigmoid) recovery would imply that recovery rates could be more precisely estimated by getting observations in the steeper part of the function (around the time for 50% recovery). This might be considered in future design of gear impact studies.

The documents provided for this review do not give a complete list of all literature considered. The Appendix B section B.2.4 lists references to the literature directly used for estimating q and ρ. This and other related literature is further described in section 3.4.3 of the main EFH DEIS (document 8, handed out to the panellists at the review meeting). This section also refers to a comprehensive review of international literature (Johnsen 2002). This review (covering nearly 250 international publications) has been prepared by NMFS Office of Habitat Conservation with the particular intent to provide a reference document to assist in assessing adverse effects of fishing to EFH. I assume that Johnsen (2002) and the reference list of Appendix B comprise the main scientific basis for the work.

Some of the comments to the entire EFH DEIS criticise the work for not reflecting all relevant literature. A letter from Shester (document 7f) lists 193 references “not used in Alaska Region EFH DEIS”, and a letter from The Ocean Conservancy Oceana (document 7f) lists 198 references (most of them with abstracts) “not used in Alaska Region EFH DEIS”. The latter list seems to contain the all of Shester’s list. A quick check shows that about 40 of these 198 are included in the review by Johnsen (2002). Then there still remain some 150 references that a number of scientists consider to be relevant for the work. Our review task focused on Appendix B, while those literature lists relate to the whole DEIS. Since I am unfamiliar with a lot of this literature I am not able to evaluate the details within the time frame for this review. Looking at some of the abstracts it seems, however, evident that some important documents on the "missing list" should have been considered for the Appendix B work. On the other hand, all the main topics are already covered by relevant literature, and a more complete literature survey would probably not have changed the general approach or any of the main results. Depending on the weight given to this additional literature, some of the conclusions drawn from the results might possibly have been modified.

2. Does the DEIS Appendix B analysis provide a reasonable approach for identifying whether any Council-managed fishing activities adversely affect EFH in a manner that is more than minimal and not temporary in nature? (For purposes of this question, the terms "temporary" and "minimal" should be interpreted consistent with the preamble to the EFH regulations: "Temporary impacts are those that are limited in duration and that allow the particular environment to recover without measurable impact. Minimal impacts are those that may result in relatively small changes in the affected environment and insignificant changes in ecological functions.") To answer this question, the panel shall address at least the following issues:

a. Does the DEIS Appendix B analysis apply an appropriate standard (including the consideration of stock status relative to MSST) for determining whether fishing alters the capacity of EFH to support managed species, a sustainable fishery, and the managed species' contribution to a healthy ecosystem?

The gear impacts (LEIs) are calculated for each of the "habitat features", including infauna, epifauna, living structure, nonliving structure, and hard coral. In spite of all the uncertainties, it seems that the main conclusions from the gear impact analysis are rather robust. Gear impacts on these features are (due to the assumed continued fixed fishing intensity) <u>not temporary</u>. For features with high LEI values those effects have to be considered as <u>more than minimal</u>. High LEI values are observed for the features with very low recovery rate.

The report does not extensively discuss the direct effects on these examined features; instead it focuses on whether fishing alters the capacity of EFH to support managed species, a sustainable fishery, and the managed species' contribution to a healthy ecosystem (as indicated by the question above).

The difficult and challenging step is to evaluate how the gear effects quantified by LEI values relate to features that are essential for managed species. For instance, assume that for a certain managed species all the important prey items among infauna and epifauna have been identified. The LEI values (mainly relating to reduction in biomass or abundance) will still not be a direct measure of reduced food production. The relationship between biomass and production of the prey species needs to be established. Such relationships could be assumed to be similar to those used for managed stocks (dome shaped), in which case one might even reach the conclusion that a moderate level of gear impact could be beneficial for production both for the prey and its predators. A potential shelter for certain managed species provided by living structure may also cause a nonlinear relationship between the LEI values and the production by the managed stock. Some furrows through a coral reef may increase the shelter (and thereby survival) of the managed species, while a depletion of the entire reef means no shelter and reduced survival.

Apparently, the knowledge about such links has been considered to be too scarce to allow for any quantitative relationships. Stock experts have, on a more qualitative basis, given their evaluation of links based on their probability, or lack of knowledge, relating to the topics spawning/breeding, feeding of adults, and growth to maturity (Section B.3 and Table B.3-1.). I find it appropriate that this qualitative approach has been chosen, on the background of the incomplete knowledge of the processes involved.

Shester (document 7a) has suggested that this could be done more quantitatively by assuming that estimated reduction in habitat features could be (linearly) translated into reduced carrying capacity in a production model. This might be an interesting exercise, but it would involve considerable amounts of guesswork (in addition to the linearity-assumption). Carrying capacity (K) has conceptually some biological meaning. However, when used for a simple two-parameter (r and K) fit of empirical data (most frequently data on harvest against a measure of stock size), it might become very difficult to relate estimated K-values to specific biological processes. It could, for instance, be argued that factors affecting recruitment (and even growth) would relate more to r than to K.

Since the focus is on the EFH and its capacity to support the managed species, sustain fisheries, and the species contribution to a healthy ecosystem, it seems quite appropriate to use some observed measure of the overall stock productivity as an evaluation criterion. If the production is sufficient, it is a sign that the EFH provides sufficient support for the stock, that the fishery will be sustainable, and that the stock should be able to play its role in the ecosystem.

The first problem in this approach is to set the standard for what is “sufficient” production. Another weakness of such an approach is that stock production is a second or higher order effect of gear impacts on EFH, and that production may be at least as much influenced by other factors than gear impacts. This means that there might be considerable time lags between cause and effect, and that moderate effects might be difficult to detect due to “noise” from additional factors (causing large annual variations in production). The problem then is that many years of observation are needed to detect a trend with reasonable statistical significance. In addition, for habitat features with low recovery rates, equilibrium may not yet have been reached (the time period with fishing intensity at current level is too short), and production may decrease in the future. Especially in case of nonlinear effects, as discussed above, a gradually increasing cumulative gear impact (progress towards equilibrium) may, after a fairly long period of stable fish production, reach a critical level where production may show a sharp decrease.

In the evaluation of effects on managed species (section B 3), stock size relative to MSST is used as an evaluation criterion. Strictly stock size itself is not directly a measure of productivity, but stocks classified as above MSST are considered to allow for maximum yield (production) in the long term. MSST is established on the basis of the known history of stock size and catches (30-40 yrs for several of the managed

Alaska stocks). The reviewed material contains various descriptions of MSST. According to Tagart (document 7b), a stock is currently classified to be above MSST if the spawning stock is above B_{MSY} next year (upcoming harvest year), or if it is both above $1/2B_{MSY}$ in next year and above B_{MSY} in the 10^{th} year when projected forward from next year, applying the upper bound of fishing mortality for the entire 10-year period. In all other cases it is classified as being below MSST. B_{MSY} is the spawning stock size that maximises production (usually estimated as the equilibrium spawning stock corresponding to the fishing mortality that generates the highest long-term yield). The 10-year prediction in cases when the stock is between ½ B_{MSY} and B_{MSY} is mainly a test that the upper fishing mortality limit defined in the management plan is sufficiently low to allow the stock to rebuild from present level to B_{MSY} under the assumption of normal recruitment. It was explained during the review meeting that such predictions were obtained through several hundred stochastic runs where unknown future year classes were estimated by sampling at random among those observed in the known stock history. The median spawning stock in the 10^{th} yr is then compared to B_{MSY}. The 10-year prediction does therefore not contain any additional observations as compared to the assessment of the current stock situation. As a part of a management plan, it might be useful to include this 10-year test for stock classification purposes, but for evaluating current production the information is blurred by the assumption about future recruitment. For this purpose, B_{MSY} itself is a better measure than MSST. The former would also be more transparent and consistent among stocks.

As most other biological reference points, B_{MSY} (and thereby MSST) is conditional to the time series of available data. If production has become reduced due to fishing impact on EFH before the data period, the MSST criterion could be misleading for evaluating the effect of current fishing intensity on EFH. If the time series covers a very narrow range of stock sizes and yields, B_{MSY} is estimated with high uncertainty, and wrong conclusions may evolve if the stock falls outside the experienced range of variation. This together with the concerns raised above (time-lag between cause and effect, noise caused by other factors, and possible non-equilibrium) lead to the conclusion that stock size relative to MSST is not a powerful test to prove or disprove that current fishing affects EFH in a way that is more than minimal and not temporary.

Some more information might have been obtained by observing the various sources to stock production separately, including recruitment, individual growth and natural mortality. Time series of recruitment and weight at age could be examined for recent trends (for most stocks, data on natural mortality are very scarce). A declining trend in recruitment would possibly be detected earlier than a reduced biomass. For some stocks treated in section B 3, a declining trend in recruitment was reported, and environmental causes (mainly a temperature change) were considered more likely than gear impacts. This illustrates the problem of detecting gear impacts among “noise” from other sources when observing higher order effects.

The MSST values are designed as benchmarks in the existing Fishery Management Plans for keeping stocks at a level that ensures high production and sustainable fisheries. It is therefore reasonable to include these considerations in the evaluation. Since MSST aims for maximum long term yield, a stock above MSST is a sign of a healthy stock (which may not be true for a number of management thresholds, or lack thereof, in other parts of the world). A biomass above B_{MSY} would be a more unambiguous sign of a healthy stock, which would be further confirmed if recent recruitments are at or above long term average.

In my view, the MSST considerations have been given too much weight in the stock by stock evaluations and have been interpreted in the direction of no evidence of adverse effects of fishing on EFH. I would, in cases where stocks are above Bmsy, conclude that the stock assessments provide no evidence for reduced production. This does not exclude the potential for possible effects to exist and which might reduce stocks and fisheries in the future. For stocks observed to be associated with slowly recovering living structure, I warn that these species might be dependent on vulnerable habitats, and further protection of those habitats would be a precautionary step to reduce the risk of future losses to the stock, fishery and ecosystem.

b. Does the DEIS Appendix B analysis give appropriate consideration to localized habitat impacts that may reduce the capacity of EFH to support managed species in a given area, even if those impacts do not affect a species at the level of an entire stock or population?

This question seems to be somewhat related to how the whole EFH process is organised. Appendix B largely focuses on overall gear effects (on the entire stock over their main distribution areas), while it is indicated that more local effects is a topic for a special work on Habitat Areas of Particular Concern (HAPC). This impression was confirmed at the review meeting. Appendix B presents tools for examining possible local gear effects on sea floor, but focuses the analysis on overall effects. The EIS Executive summary indicates five broad alternative routes for identifying HAPCs and the way to proceed seems rather open. It seems possible that gear impact on sea floor may not be the main criterion for selecting HAPCs. The EFH DEIS Appendix J states that HAPC will be proposed through a public process and that one of the proposed priorities (for selecting HAPC candidates) is that such sites must be largely undisturbed and occur outside core fishing areas.

As an outsider, I would consider Appendix B brought some more details on vulnerable local habitat features and discussed further the possible connections to those managed species that might tend to aggregate in vulnerable habitats.

Although not presented in all details in the report, the results available to the stock experts included detailed maps of gear impacts (and fishing intensities). In most cases these have been commented upon in the stock by stock descriptions. For Pacific Ocean Perch, for example, the risk involved in fishing on vulnerable habitats is not indicated and adverse effects are classified as MT (either Minimal or Temporary or no effect), mainly based on the MSST criterion.

Questions relating to possible local sub-populations were discussed at the review meeting. We were informed that Atka mackerel is a species that may consist of several sub-populations, because the fishery for that species tends to focus on limited fishing grounds. Genetic studies have not confirmed this, and it is observed that when a concentration of fish is diluted due to intense fishing, a new concentration may gradually build up again, presumably originating from larger areas where they might be more sparsely distributed. Thus, this species may be less stationary than previously thought, and there might be considerable exchange between the different, known concentration areas.

The geographical distribution of a fish stock will influence the stock's contribution to a healthy ecosystem. If fishing impacts the EFH in a way that reduces the stock distribution it might both reduce the stock, the fishery and the stock's contribution to a healthy ecosystem. Fish distribution maps by species in the annual survey in the Bering Sea were shown at the review meeting. These maps showed large annual variations in distribution, which implies that the stocks are less vulnerable to local gear effects than what might be inferred by just looking at an average fish distribution. In these sub-arctic waters, the distribution of several species might be more governed by properties of the water masses (in particular, temperature) than by properties of the sea floor. For some flatfish stocks, however, there seemed to be some favourite areas. Only the relative densities changed between those areas, and some areas were not used when covered by cold water. At the meeting the distribution maps were not examined for detecting a shrinking trend in distribution area (other than temporal shrinkage or shift associated with changed temperature distribution). Shrinkage of distribution area could have been used in Appendix B as an additional sign of adverse effects of fishing on EFH.

c. Other issues relevant to question 2.

The assumption about continued fixed fishing intensity makes the effects expressed through the LEI values inherently not temporary. The model formulation, however, implies that removing the fishing intensity for a sufficient number of years will allow for a full recovery of these habitat features. This further implies no risk for irreversible damage, and the cost of postponing conservation measures seems small. This may not be true for habitat features with very low recovery rates. Without further protection, there might be a risk that such features (at least locally) may never recover. I consider that this rather obvious warning should have been spelled out more clearly in Appendix B.

Direct effects on target species (other than by catching them) is not discussed. Some species have demersal eggs that might get hurt or buried down by fishing gears. In some cases, fishing at spawning migrations or spawning sites might influence the spawning process. These effects would not fit into the LEI estimation, but should have been considered in the evaluation of stocks.

3. What, if any, improvements should NMFS consider making to the model, or to its application in the context of the DEIS, given the limited data available to use for input parameters?

My impression of the current availability of data tells me that there is not much knowledge to be gained by modifying the model. I consider this as a first step in a rather new area for quantitative studies. As knowledge over the years may accumulate, a model that can accommodate seasonal effects might become feasible.

Some additional work could be done with the available data and with some additional data that would not be too laborious to collect. Information on fishermen's behaviour (preference for certain substrates/habitats) could be used to get a more realistic distribution of fishing intensity relative to habitat types. The effect of including more data could be explored. This applies to information of substrates and the use of observer data.

Conclusions/recommendations

In general, the model and analysis are good. I encourage relevant experts to have a new look at some data proposed for use. I recommend using stock biomass relative to B_{MSY} , recruitment trends, and signs of shrinking stock distribution as criteria for detecting the stocks' response to possible adverse effect of fishing on habitat (instead of MSST). In cases where a probable link between a habitat feature and fish production is recognised, high LEI values should be taken as a warning sign and precautionary conservation measures should be advised.

APPENDIX I: Bibliography of any materials relied upon by the panel

Material made available for review at 3. June, 2004 at the website:

http://www.fakr.noaa.gov/habitat/cie/review.htm

1. The Executive Summary from the *Draft Environmental Impact Statement for Essential Fish Habitat Identification and Conservation in Alaska* (11 pages plus tables and figures);
2. The evaluation of fishing activities that may adversely affect EFH (Appendix B to the DEIS; 76 pages plus tables and figures);
3. EFH sections of the minutes of the Council's Scientific and Statistical Committee meetings in October 2002, December 2002, February 2003, April 2003, June 2003, and October 2003 (each is approximately 2 pages);
4. Section 303(a)(7) of the Magnuson-Stevens Act;
5. Pertinent excerpts from the NMFS regulations for EFH (50 CFR 600.10 and 600.815(a)(2)) and the associated preamble (67 FR 2354-2355);
6. Pertinent excerpts from the Magnuson-Stevens Act National Standard 1 Guidelines (50 CFR 600.310(d)); and
7. Selected public comments on the DEIS that are pertinent to Appendix B, including criticisms of the analytical approach (comments to be selected by NMFS after the close of the public comment period on April 15, 2004).
    a. Letter from G. Shester, April 13, 2004. RE: Comments on Alaska Region Essential Fish Habitat Draft Environmental Impact Statement (24 pages)
    b. J.V. Tagart on behalf of Marine Conservation Alliance, April 14, 2004. Technical review of the Appendix B: Evaluation of fishing activities that may adversely affect essential fish habitat. (26 pages)
    c. Alaska Marine Conservation Council (Ben Entiknap), April 14, 2004. RE: Draft Environmental Impact Statement For Essential Fish Habitat Identification and Conservation in Alaska. (20 pages)
    d. The Ocean Conservancy Oceana (K.Balliet, J.Ayers, M.J.Spalding, G. Leape, C.Bosman and J.Curland), April 15, 2004. RE: Comments on the Draft Environmental Impact Statement For Essential Fish Habitat Identification and Conservation in Alaska. (21 pages)

Additional public comments pertinent to Appendix B made available at 23. June, 2004 at the above referred website:

7e. Shester, G and Ayers, J. A cost Effective Approach to protecting Deep Sea Coral and Sponge Ecosystems with an Application to Alaska's Aleutian Islands Region. MS submitted to 2nd International Symposium on Deep Sea Corals. (Attachment to letter from Shester (7a)). (24 pages).

7f. Letter by e-mail from G.Shester, April 14, 2004. RE: Review of Literature Not Used in Alaska Region EFH DEIS. (28 pages literature list).

7g. Letter from Marine Conservation Alliance, April 15, 2004. Comments on the Draft Environmental Impact Statement on Essential Fish Habitat. (30 pages, pluss 3 attachments (including 7b)).

7h. Five attachments to letter from The Ocean Conservancy Oceana (7d).

Presentations and documents available at the review meeting 29. June, 2004:

8. Effects of Fishing Activities on Fish Habitat, copy of the EFH DEIS section 3.4.3 (20 pages +Table and Figures).
9. Conners, M.E., Hollowed, A.B., and Brown, E. 2002. Retrospective analysis of Bering Sea bottom trawl surveys: regime shift and ecosystem reorganization. Progress in Oceanography 55 (2002):209-222.
10. Kurland, Jon. Presentation. Background behind the EFH Environmental Impact Statement.
11. Fujioka, Jeff and Rose, Craig, Presentation. Fishing effects model. Development and evolution of the model. Application of the model to the EFH DEIS.
12. Rose, Craig and Hollowed, Anne. Presentation. Analytical approach for assessing effects on EFH and managed species.

Found on the web:
http://www.fakr.noaa.gov/habitat/seis/efheis.htm

13. The entire EFH DEIS

http://www.nmfs.noaa.gov/habitat/habitatprotection/essentialfishhabitat10.htm

13. Johnsen, K.A. 2002. A review of national and international literature on the effects of fishing on benthic haibtats. NOAA Technical Memorandum NMFS-F/SPO-57. 72 pp.

In line with CIE procedures, the panellists were encouraged to use the time up to reporting deadline to evaluate and report the material provided before and during the review meeting. Therefore, some unsolicited material received after the meeting is not commented upon here.

APPENDIX II: STATEMENT OF WORK

Statement of Work

Consulting Agreement between the University of Miami and Dr. Asgeir Aglen

Background

The Magnuson-Stevens Fishery Conservation and Management Act requires that every fishery management plan describe and identify Essential Fish Habitat (EFH) for the fishery, minimize to the extent practicable the adverse effects of fishing on EFH, and identify other measures to promote the conservation and enhancement of EFH. NMFS and the North Pacific Fishery Management Council recently developed a draft environmental impact statement (DEIS) to consider the impacts of incorporating new EFH provisions into the Council's fishery management plans. The DEIS evaluates three actions: (1) describing and identifying EFH for fisheries managed by the Council; (2) adopting an approach for the Council to identify Habitat Areas of Particular Concern within EFH; and (3) minimizing to the extent practicable the adverse effects of Council-managed fishing on EFH. Most of the controversy surrounding the level of protection needed for EFH concerns the effects of fishing on sea floor habitats. Substantial differences of opinion exist as to the extent and significance of habitat alteration caused by bottom trawling and other fishing activities. Although an increasing body of scientific literature discusses the effects of fishing on habitat, there is no consensus within the scientific community on an appropriate methodology for analyzing potential adverse effects.

The national EFH regulations (50 CFR 600.815(a)(2)) require an evaluation of the effects of fishing on EFH, and this evaluation appears in Appendix B to the DEIS. The evaluation has two components: a quantitative mathematical model to show the expected long term effects of fishing on habitat, and a qualitative assessment of how those changes affect fish stocks. The model estimates the proportional reductions in habitat features relative to an unfished state, assuming that fishing will continue at the current intensity and distribution until the alterations to habitat and the recovery of disturbed habitat reach equilibrium. The model provides a tool for bringing together all available information on the effects of fishing on habitat, such as fishing gear types and sizes used in Alaska fisheries, fishing intensity information from observer data, and gear impacts and recovery rates for different habitat types. Due to the uncertainty regarding some input parameters (e.g., recovery rates of different habitat types), the results of the model are displayed as point estimates as well as a range of potential effects.

After considering the available tools and methodologies for assessing effects of fishing on habitat, the Council and its Scientific and Statistical Committee concluded that the model incorporates the best available scientific information and provides a good approach to understanding the impacts of fishing activities on habitat. Nevertheless, the model and its application have many limitations. Both the developing state of this new model and the limited quality of available data to estimate input parameters prevent drawing a complete picture of the effects of fishing on EFH. The model incorporates a number of assumptions about habitat effect rates, habitat recovery rates, habitat distribution, and habitat use by managed species. The quantitative outputs of the analysis may convey an impression of rigor and precision, but the results actually are subject to considerable uncertainty.

One major limitation of the model is that it does not consider the habitat requirements of managed species or the distribution of their use of habitat features. Therefore, DEIS analysts were asked to use the model output to address whether continued fishing at the current rate and intensity is likely to alter the ability of a managed species to sustain itself over the long term. In other words, are the fisheries, as they are currently conducted, affecting habitat that is essential to the welfare of each managed species? To help answer that question, the analysts considered available information about the habitats used by managed species. The analysts also considered the ability of each stock to stay above its minimum stock size threshold (MSST), after at least thirty years of fishing at equal or higher intensities. MSST is the level below which a stock is in jeopardy of not being able to produce its maximum sustainable yield on a continuing basis.

The DEIS analysis concludes that despite persistent disturbance to certain habitats, the effects on EFH are minimal because there is no indication that continued fishing activities at the current rate and intensity would alter the capacity of EFH to support healthy populations of managed species over the long term. The DEIS finds that no Council-managed fishing activities have more than minimal and temporary adverse effects on EFH, which is the regulatory standard requiring action to minimize adverse effects under the Magnuson-Stevens Act. Additionally, the analysis concludes that all fishing activities combined have minimal, but not necessarily temporary, effects on EFH. These findings suggest that no additional management actions are required pursuant to the EFH regulations.

<u>Expertise Needed for the Review</u>

The review panel shall comprise six individuals. Panelists shall have expertise in benthic ecology, fishery biology, fishing gear technology, ecological modeling, and/or closely related disciplines.

<u>Information to be Reviewed</u>

The CIE panel shall review the following materials:

- The Executive Summary from the *Draft Environmental Impact Statement for Essential Fish Habitat Identification and Conservation in Alaska* (11 pages plus tables and figures);
- The evaluation of fishing activities that may adversely affect EFH (Appendix B to the DEIS; 76 pages plus tables and figures);
- EFH sections of the minutes of the Council's Scientific and Statistical Committee meetings in October 2002, December 2002, February 2003, April 2003, June 2003, and October 2003 (each is approximately 2 pages);
- Section 303(a)(7) of the Magnuson-Stevens Act;
- Pertinent excerpts from the NMFS regulations for EFH (50 CFR 600.10 and 600.815(a)(2)) and the associated preamble (67 FR 2354-2355);
- Pertinent excerpts from the Magnuson-Stevens Act National Standard 1 Guidelines (50 CFR 600.310(d)); and

- Selected public comments on the DEIS that are pertinent to Appendix B, including criticisms of the analytical approach (comments to be selected by NMFS after the close of the public comment period on April 15, 2004).

Panelists should refer to the following website to access all background material.

http://www.fakr.noaa.gov/habitat/cie/review.htm

Questions to be Answered

Given the context of the Magnuson-Stevens Act requirements and the EFH regulations, the CIE reviewers shall address the following issues:

1. Does the model incorporate the best available scientific information and provide a reasonable approach to understanding the effects of fishing on habitat in Alaska?

2. Does the DEIS Appendix B analysis provide a reasonable approach for identifying whether any Council-managed fishing activities adversely affect EFH in a manner that is more than minimal and not temporary in nature? (For purposes of this question, the terms "temporary" and "minimal" should be interpreted consistent with the preamble to the EFH regulations: "Temporary impacts are those that are limited in duration and that allow the particular environment to recover without measurable impact. Minimal impacts are those that may result in relatively small changes in the affected environment and insignificant changes in ecological functions.") To answer this question, the panel shall address at least the following issues:

    a. Does the DEIS Appendix B analysis apply an appropriate standard (including the consideration of stock status relative to MSST) for determining whether fishing alters the capacity of EFH to support managed species, a sustainable fishery, and the managed species' contribution to a healthy ecosystem?

    b. Does the DEIS Appendix B analysis give appropriate consideration to localized habitat impacts that may reduce the capacity of EFH to support managed species in a given area, even if those impacts do not affect a species at the level of an entire stock or population?

3. What if any improvements should NMFS consider making to the model, or to its application in the context of the DEIS, given the limited data available to use for input parameters?

Review Process, Deliverables, and Schedule

The review panel shall consist of six members, one of whom shall serve as the Chair, as specified below.

Duties of the Panelists

1. Each panelist shall attend in person and participate in a one-day meeting with the scientists who developed the fishing-effects model and the analytical approach used to evaluate the effects of fishing in the DEIS. The meeting will be held at the Alaska Fisheries Science Center in Seattle on June 29, 2004. The meeting will be open to the public to attend, but there will be no opportunity for public testimony. The lead authors of the model, Dr. Jeffrey Fujioka and Dr. Craig Rose, will provide an overview of the model, how it was developed, how it was refined in response to comments from the Council's Scientific and Statistical Committee and other reviewers, and how it was used in the DEIS. The panel will have an opportunity to question Dr. Fujioka and Dr. Rose, as well as Dr. Anne Hollowed, who assisted in designing the analytical approach used to evaluate the effects of fishing in the DEIS. The panel shall meet in executive session at the Alaska Fisheries Science Center on June 30, 2004 to discuss the information presented, and to identify any unanswered questions.

2. Prior to the meeting, each panelist shall review the materials specified above. Panelists may submit written questions via e-mail to Jon Kurland (Jon.Kurland@noaa.gov), with copies to the Contracting Officer's Technical Representative (COTR), Stephen Brown (Stephen.K.Brown@noaa.gov), and to the CIE manager, Manoj Shivlani (mshivlani@rsmas.miami.edu) at least two weeks before the meeting to ensure topics of particular interest will be covered during the presentation.

3. Each panelist shall deliver an individual final written report containing answers to the questions posed above and any recommendations. These individual reports shall be submitted the Chair and to Dr. David Die of the University of Miami via e-mail at ddie@rsmas.miami.edu, and to Mr. Manoj Shivlani via email at mshivlani@rsmas.miami.edu no later than July 15, 2004. The reports shall include the following sections: executive summary, background, description of review activities, summary of findings, conclusions/recommendations, bibliography of any materials relied upon by the panel, and a copy of this statement of work. Please refer to the following website for additional information on report generation:
http://www.rsmas.miami.edu/groups/cimas/Report_Standard_Format.html.